REMARKS

The Examiner's comments together with the cited references have been carefully studied. Favorable reconsideration in view of the foregoing amendments and following remarks is respectfully requested.

The drawings were objected to by the Examiner. Figure 1 has been changed to correctly label it as "Prior Art." A marked-up copy of Figure 1 showing the change in red is submitted herewith along with a set (7 sheets) of formal drawings including the change to Figure 1.

Applicants herewith file a terminal disclaimer in compliance with 37 CFR 1.321(c) to overcome a double patenting rejection based on a nonstatutory double patenting ground.

Claims 9-12 were rejected under the judicially created doctrine of obviousness-type double patenting over claims 18-20 of U.S. Patent No. 6,490,746. Claim 9, as amended, requires a source of filtered downwardly directed substantially laminar flow air, and continually exhausting the partially enclosed enclosure from a location below the generally irregular surface features. Claim 12 list several more steps. In view of the amendments to claims 9-11 it is requested that the rejection be withdrawn.

Claims 9-12 are now pending in the application. Claims 1-8 have been canceled. Claim 9 herewith is amended. Claim 12 is new. Claims presently active are claims 9-12.

Claims 9-11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Young in view of Allen et al. The rejection is traversed.

Applicants take the position that Young discloses a cleaning device wherein objects to be cleaned are cylindrical and uniform in nature. For such objects, with no undulating surfaces, a simple air nozzle will provide sufficient air movement to remove the charge-neutralized particles. To further aid in the removal of particles the objects being cleaned are facing downward. This is practical in the application of cleaning beverage containers, but does not address the cleaning of parts with irregular and undulating surfaces, and which require the object being cleaned to face upward as required by subsequent operations.

In the present invention, the supply of ionized air used to neutralize and dislodge the particles adhered to the object being cleaned is supplied in such a

way that the air is focused into a sheet providing sufficient force to neutralize and remove particles from irregularly shaped objects. A simple non-focused air supply, such as a nozzle with a round aperture, would not provide enough force to a small particle without using an overwhelming amount of air. The result of this improvement has been an increased amount of force to remove particles, while using a considerably smaller volume of air. The finely focused sheet of air of the present invention provides increased force to remove particles while using less air than a nozzle would require. A vacuum pick-up coupled with a nozzle, as disclosed by Young, would disrupt the sheet of air, rendering the sheet of air less effective. The present invention uses slots at or near the bottom of the enclosure to capture and remove the particles that have been dislodged from the object thereby gaining gravity assistance to exhaust particles.

Young uses filtered air to pressurize the enclosure of the cleaning device. The present invention uses a similar flow of filtered air, common to cleanroom applications, but it presents the air from the ceiling of the enclosure, which aids in washing out the dislodged particles from the object being cleaned. Pressurizing the enclosure, as disclosed by Young, was found to result in dislodged particles escaping the enclosure. In the present invention, the downward flow of filtered air is balanced with the air removed by the exhaust slots by means of perforated plates both at the filtered air inlet, and at the exhaust fan. This results in an efficient removal of particles, without causing an outflow of air from the enclosure which in turn could contaminate subsequent operations.

An advantage of the present invention is that by using highly focused sheets of air, irregular and undulating object surfaces can be cleaned. The device uses less compressed air to achieve a high cleaning efficiency, reducing the cost to operate. The high velocity/low volume exhaust slots at or near the bottom of the device provide adequate particle removal without disrupting the supply of ionized air so that the object being cleaned can be facing upward, or in any direction required by the manufacturing process. The downward flow of filtered air assists in the removal of particles from the part that has been cleaned even when facing upward. The perforated plate in conjunction with the filter housing provides a uniform flow of air from top to bottom exhaust, in a near laminar flow. Laminar flow, also known as unidirectional flow, is commonly used to effectively transport particles away from a manufacturing

process. Simply pressurizing the enclosure does not provide this benefit. The balancing of the airflow within the device prevents surrounding factory air from entering the enclosure, yet also limits the amount of particle laden air that leaves the enclosure.

Young organizes the air nozzles in a linear fashion, but this does not create a curtain-like stream of air. The present invention uses an airflow device that focuses the stream of air into a finely focused sheet of air that can be used at a variety of angles to apply a maximum force of air while utilizing significantly less volume of air that would be possible with nozzles.

Also, Young describes objects, that while not flat, are still comprised of a very regular surface, in particular, a cylinder. In contrast, the present invention can remove particles from a highly irregular surface, consisting of multiple deep pockets, and object surfaces facing in various directions. In the case of the objects cleaned during tests, the objects were irregular to the point that most of the surface area was not visible from any single point on the surface. This is in sharp contrast to cleaning the inside of a cylinder.

Allen et al. cite ionization results that are low in efficiency due to the separate locations of the ion source away from the stream of air. There is no mechanism for delivering the ions to the surface to be cleaned before they would dissipate. Such low efficiency would not provide adequate neutralization for the removal of fine dust that could interfere with the operation of some devices. The input airflow is only provided by the air knives. This inflow of air is balanced by the outlet fan, providing an essentially neutral air balance to the surrounding room. In order to maintain this balance two very different airflows must be balanced; a pair of fine slots air inlets, and a pair of considerably larger filter and fan units. As a result, the air curtains must be overpowered in order to provide adequate volume to be able to draw the particles removed from the product upward, and to hold them in suspension until removed.

In contrast, the present invention uses a downward flow of filtered air, delivered over a large area relative to the top wall of the enclosure, to provide a positive pressure within the enclosure, which in turn is balanced by the outflow at the slots near the bottom of the enclosure. This allows the inlet air from the air curtains to be a relatively small part of the total inlet air volume. This is important as the air knife, or air curtain, operates considerably better at lower

flows, as the air curtain has less divergence and less turbulence at lower pressures. In addition, the slow downward airflow, which is nearly laminar in nature, does not require the dislodged particles to be held in suspension, but rather washes the dislodged particles out of, and away from the product, before they have a chance to recontaminate the product.

Young does describe providing a filtered flow of air to the chamber to provide a positive pressure. The means by which this is done is through a round opening at one end of the chamber. By applying the airflow in this manner, the air must be of a higher velocity than in the present invention, and flowing in a turbulent fashion to maintain a positive pressure. This system works satisfactorily for the device as described by Young due to the enclosed nature of the part being cleaned. The cans prevent this high velocity turbulent airflow from disrupting the flow of ionized air from the nozzle. With the present invention, the parts being cleaned are not restricted to facing downward, and are not a smooth cylindrical shape. For this reason the air curtain must be employed to provide sufficient force to all part surfaces, regardless of the angle presented to the cleaning system. To utilize a simple air hose inlet into the chamber to provide positive pressure would produce a high level of turbulence that would disrupt the air stream intended to neutralize and clean the parts. So the purpose of the overhead filtered air unit is not merely to provide a positive pressure, but as importantly to do so with a low velocity of air traveling in a nearly laminar direction downward so as to not disrupt the sheet of air from the air knives, and yet have enough velocity to carry away dislodged particles towards the exhaust slots, where they are captured by the higher velocity airflow leaving the slots.

The combination of Young and Allen et al. does not teach or suggest a low velocity flow of filtered air delivered in a near laminar airflow, or the mechanism of the exhaust slots, which provide a means of accelerating the same volume of air in order to draw away the dislodged particles. Claim 9 now requires a downwardly directed substantially laminar air flow, and continually exhausting the partially enclosed enclosure from a location below the generally irregular surface features so as to eliminate particles dislodged from the generally irregular surface features. Claim 12 requires an exhaust system for exhausting particles cleaned from the objects and directing filtered air through the partially

enclosed enclosure over the objects to the exhaust system and continually exhausting the partially enclosed enclosure through the exhaust system and eliminating the particles dislodged from the generally irregular surface features. New claim 12 also requires entraining a cloud of ions from the ionizing member in a curtain-like stream of air and directing the curtain-like stream of air with the entrained ions across the irregular surface features of the objects.

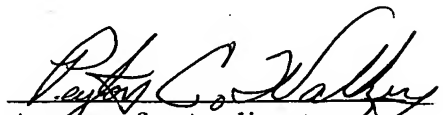
In view thereof, it follows that the subject matter of the claims would not have been obvious of Young in view of Allen et al. at the time the invention was made.

Applicants have reviewed the prior art made of record, including Young and Allen et al. and believe that singly or in any suitable combination, they do not render Applicants' claimed invention unpatentable.

In view of the foregoing remarks and amendment, the claims 9-12 are now deemed allowable and such favorable action is courteously solicited.

Should the Examiner consider that additional amendments are necessary to place the application in condition for allowance, the favor is requested of a telephone call to the undersigned counsel for the purpose of discussing such amendments.

Respectfully submitted,



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Enclosures: Terminal Disclaimer
Replacement Figure 1
Annotated Sheet Showing Changes
Letter to the Draftsperson
Copy of Formal Drawings